ICT 2206 – Internet Programming

Individual Project – Third Submission

Title: **Design and Implement a Network Infrastructure with VLANs, DHCP Servers, Firewalls, and Internet Connectivity**

Objective:

Design a network for a mid-sized company using Cisco Packet Tracer. The project requires the implementation of VLANs for department separation, DHCP servers for automatic IP assignment, a firewall for network security, and internet connectivity for external communication.

Intended Learning Outcomes:

By completing this project, you will demonstrate skills in VLAN configuration, inter-VLAN routing, dynamic IP address assignment, firewall setup, and basic internet connectivity for an enterprise network.

Scenario:

You are a network administrator for a company that has *n* user departments, *m* administrative departments, *p* academic departments, and 1 security and emergency response department. Each department must be assigned to its own VLAN for logical separation and security. The company also requires dynamic IP address assignment using DHCP, with a single DHCP server with VLAN interfaces for the internal networks.

You must configure a firewall to secure the network and allow selective internet access. Additionally, three computers should be allocated for guest access in each user department so that visitors can access the services the relevant department provides. These three computers should be allocated the last three statically allocated IP addresses in each department. These computers are only allowed to access the services available in the department (no access to the Internet or outside the respective VLAN).

Network Requirements:

1. **Departments (VLANs)**:
    - Each VLAN should be assigned numbers in the range of 10, 20, 30, …
    - Each VLAN should be assigned separate /24 address ranges.
2. **Devices**:
    - Each VLAN should be serviced with a separate Layer 2 switch
    - 1 Router (Layer 3, configured as a gateway and firewall)
    - 1 Internet Cloud (Simulated internet access)
    - 1 DHCP server with VLAN interfaces
    - At least 3 PCs for each department
    - Additional 3 PCs for each department with static IP addresses
3. **DHCP Configuration**:
    - For each VLAN, the upper half of the allocated addresses should be provided through DHCP
4. **Firewall**:
    - Permit internet access for all VLANs.
    - Block external access to internal networks.
    - Block the PCs with static IP addresses from accessing outside their VLANs.
5. **Internet Connectivity**:
    - Connect the router to an ISP via the internet cloud (use simulated connectivity).

Changes in the Scenario for the Third Submission:

PCs in the administrative departments should be able to access all PCs in user departments except the PCs allocated for guest access. However, PCs in one administrative department should be denied access to other administrative departments (if any) or the emergency response department.

Network Requirements:

1. **Departments (VLANs)**:
    - No change.
2. **Devices**:
    - No change.

3. **DHCP Configuration**:
    - No change.
4. **Firewall**:
    - Allow PCs in the management networks to access PCs in the user departments
    - Block PCs in the management networks from accessing PCs allocated for guest access in user departments.
    - Block PCs in one management network from accessing other management networks or the emergency response department.
5. **Internet Connectivity**:
    - No change.

Tasks to Complete for Submission 03:

1. **Network Topology Design**:
    - No change.
2. **VLAN Configuration**:
    - No change.
3. **Router Configuration**:
    - No change.
4. **DHCP Server Setup**:
    - No change.
5. **Firewall Configuration**:
    - Allow PCs in management networks to access the user departments.
    - Block PCs in management networks from accessing PCs allocated for guest access in each user department
    - Block PCs in management networks from accessing PCs in the emergency response department.
6. **Internet Connectivity**:
    - No change.
7. **Testing and Verification**:
    - Ensure that PCs in management departments can communicate with PCs in the user departments except the PCs allocated for guest access

and cannot communicate with PCs in the emergency response department.

8. **Documentation**:
    - Document all configurations (commands) for the firewall and the complete set of firewall rules.

Submission Requirements:

- Packet Tracer Project File (.pkt)
- Text file containing all configurations (commands) for the firewall and the complete set of firewall rules

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